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(71) Applicant(s)

Mitel Corporation
(Incorporated in Canada - Ontario)
PO Box 13089, 350 Legget Drive, Kanata, Ontario,
K2K 1X3, Canada

(72) Inventor(s)

John Needham
Martin Moody

(74) Agent and/or Address for Service

Stephenson Harwood
One, St. Paul's Churchyard, LONDON, EC4M 8SH,
United Kingdom

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(58) Field of Search

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(54) Abstract Title

Multi-line telephone system emergency call processing

(57) A system for handling a call requiring non-standard processing to a call answer point and for providing location information concerning the call to the call answer point, comprising a call routing apparatus for identifying the call as requiring non-standard processing and in response providing a priority routing for the call, translation table apparatus for receiving the call via the priority routing and in response assigning a predetermined designation for indicating the location information, protocol harmonization apparatus for formatting the call for digital transmission to the call answer point, including inserting the predetermined designation in an information portion of the digital transmission, and digital interface apparatus for receiving the call properly formatted for the digital transmission and in response transmitting the call to the call answer point, whereupon the call answer point ascertains the location of origination of the call from the predetermined designation.

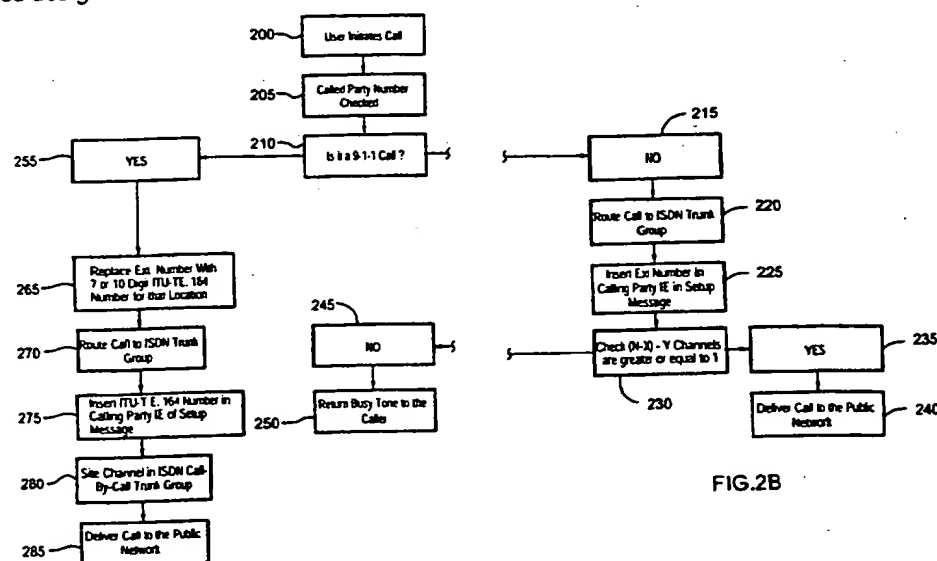


FIG.2B

FIG.2A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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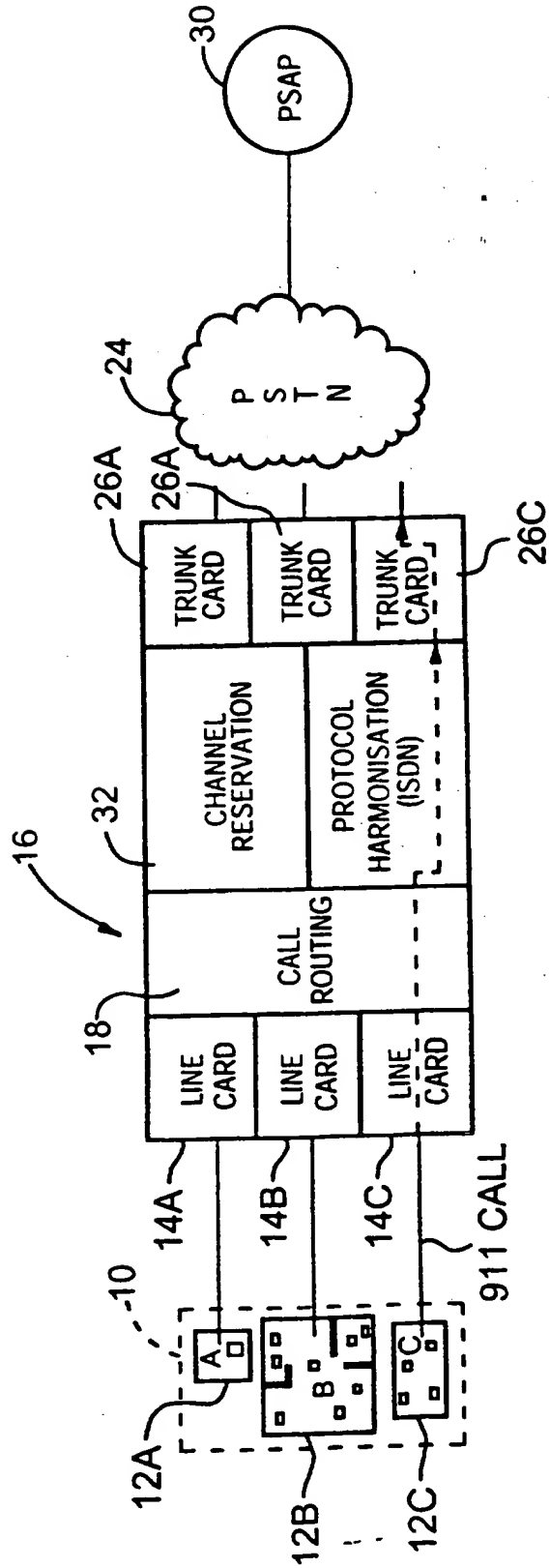


FIG. 1

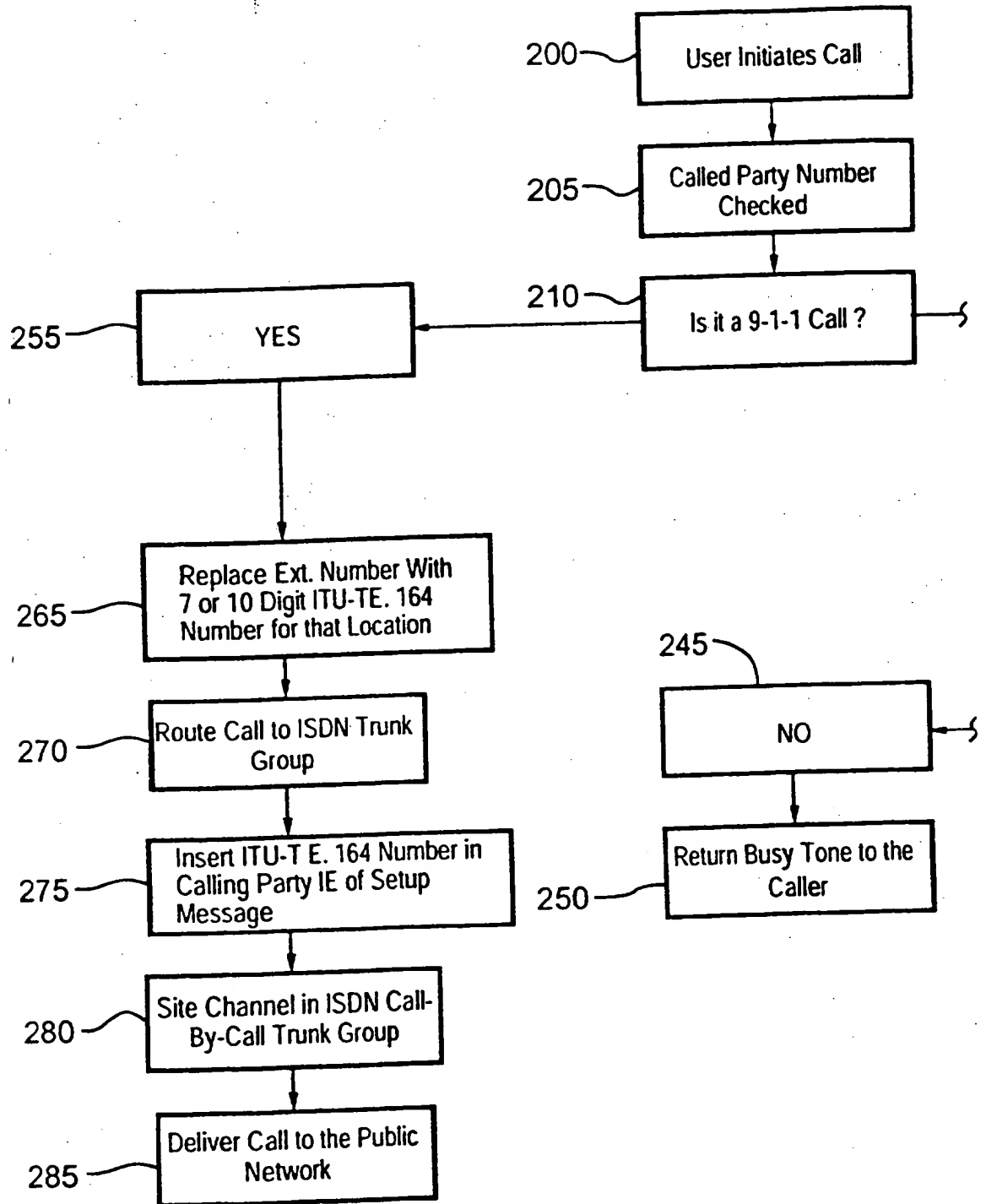


FIG. 2A

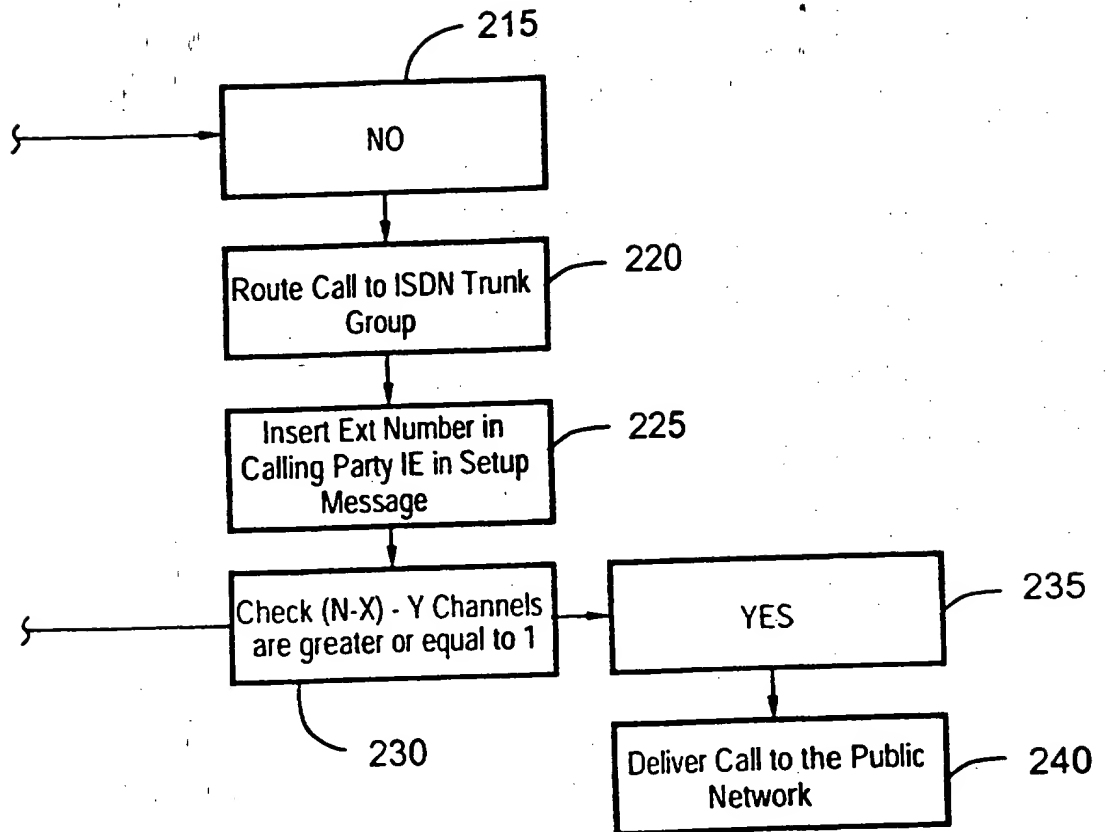


FIG.2B

MULTI-LINE TELEPHONE SYSTEM EMERGENCY CALL PROCESSING

The present invention relates in general to emergency call processing and more particularly to a system for special call handling and providing identification information from a multi-line telephone system to a public safety answering point (PSAP) for a call requiring specific location identification.

BACKGROUND OF THE INVENTION

10 An important requirement for emergency 911 call systems is the identification of the location of a caller initiating an emergency call. For example, in situations where a caller is unable to communicate with the emergency operator, the automatic identification of the location of the call enables the operator to dispatch emergency services to the physical location from which the call originated.

15 The identification of the caller initiating an emergency call is rendered difficult in multi-line systems such as PBXs because a plurality of extensions, some of which may be at disparate locations, are all identified by the same pilot number. Thus, it is difficult to pinpoint the exact location of the originating call from among the plurality of extensions.

20 U.S. Patent 5,347,568 (Moody, et al) discloses a solution to the problem of positively identifying a caller from among a plurality of extensions in a multi-line telephone system. Specifically, a dedicated adjunct (referred to in the '568 Patent as a station translation system (STS)) is connected to the PBX via a dedicated tie line. In response to a user initiating a 911 emergency call, the call is recognized by the PBX
25 as being an emergency call and is routed to the STS, rather than via the normal PBX trunk lines to the central office (CO), which then identifies the calling party station, harmonizes the protocol of the PBX to an ANI (Automatic Number Identification) number which is recognizable by the emergency call network, and routes the call to dedicated trunks in the emergency call network

30 Although the system disclosed in the '568 Patent addresses the problem of identifying the location of a station originating an emergency call in a multi-line system, an expensive and difficult interface is required between the PBX and STS, which permanently occupies a slot in the PBX and requires adjunct hardware and special emergency trunks to connect to the emergency network.

Considerable discussion and research has been engendered concerning the desirability of using ISDN (Integrated Services Digital Network) for providing 911 emergency services. Unfortunately, standards committees have thus far been unable to propose an acceptable solution to the problem of how to handle location identification in the ISDN protocol and have not addressed other special needs of an emergency call such as the requirement for guaranteed channel availability. In particular, existing COs typically screen any calling number IDs and other information assigned to a call by a user. Also, with call-by-call service it is possible that all channels may be busy when an emergency call is required, such that the call becomes blocked within the PBX.

SUMMARY OF THE INVENTION

According to the present invention, a system is provided for assigning a number which is designed to pass the screening test imposed by the COs, for identifying a physical location within a geographical area serviced by a PBX. A table is provided in the PBX (or a dedicated server connected thereto), for assigning a number associated with the telephone's physical location. The problem of emergency channel reservation is overcome according to the present invention by providing a channel allocation algorithm that always keeps one or more ISDN channels open for handling emergency calls.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention is described below with reference to the accompanying drawings, in which

Figure 1 is a block diagram of a system according to the present invention for providing identification information for a call requiring specific location identification by a call network; and

Figure 2 is a flowchart showing operation of the system according to Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 shows the basic configuration of the system according to the present invention. A plurality of users 10 are organized into individual call groups 12A, 12B, 12C, etc., identified by respective DID (Direct Inward Dialing) numbers or DN

(Directory Number) numbers. The telephone extensions from the individual groups 12A, 12B, 12C, etc., are connected to line cards 14A, 14B, 14C, etc., of a PBX 16. The PBX 16 includes switching and call processing devices of a well-known nature, represented in Figure 1 by call routing block 18. As discussed in greater detail below, after a DID number or DN has been assigned to a call, protocol harmonization takes place and the DID number or DN information is asserted via protocol harmonization block 22 for routing over the PSTN 24 via one of ISDN trunk cards 26A, 26B, 26C, etc.

It will be appreciated by a person of ordinary skill in the art that it is not essential whether DID or DN numbers are used. A DN can be a DID number but is not necessarily a DID number. According to the present invention, as set forth in greater detail below, it is important only that a number (whether DID or DN) which has only local significance to a PBX 16 is translated into a number which has universal significance to the Public Switched Telephone Network (PSTN).

Channel reservation is controlled by a channel reservation block 32 which is in communication with call routing block 18 and trunk cards 26A, 26B, 26C, etc.

In operation, when an individual (for example one of the users in call group 12C) initiates an emergency call by dialing 911 or 9-911, the call routing software 18 recognizes that the call is an emergency call which requires urgent handling. The PBX maps one or more system specific extension numbers to an ITU-T E.164 number obtained from the local telephone operating company. Each ITU-T E.164 number represents a location within a building or group of buildings served by the PBX 16. Thus, a single ITU-T E.164 number can represent multiple extension numbers that are in the same physical area. After the appropriate ITU-T E.164 number is derived, the ITU-T E.164 number is placed in the Calling Number Information Element of the Setup Message according to ITU-T recommendation Q.931, a copy of the relevant portion of which forms Appendix A to this specification. The Calling Party Number Presentation Indicator is set to "Presentation Allowed", the Bearer Capability Information Element Information transfer capability is set to "Speech" and the call is routed to one of either a ISDN PRI or BRI interface (i.e. an appropriate one of the trunks 26A, 26b, 26C, etc.).

If a PRI interface is used and all trunks are part of a call-by-call group, a channel reservation system 32 is provided to ensure that trunks are allocated for

emergency calls. The algorithm keeps track of the total number of trunks/channels available on the system and the number in use at any time. Once usage exceeds a preset threshold level, which is adjustable depending on the number of lines served by the PBX 16, a busy signal is generated for any incoming or outgoing call requests other than those requesting 911 service. A flowchart of the detailed steps according to the channel reservation system is provided as Figure 2.

According to the flowchart of Figure 2, upon user initiation of a call (Step 200), the PBX 16 checks to determine what number has been dialed (Step 205). Specifically, a determination is made as to whether the dialed number represents an emergency 911 call (Step 210).

In the event that the call is not an emergency 911 call (Step 215), the call is routed to an ISDN trunk group (Step 220), the extension number is inserted in the calling party information element in the setup message (Step 225) and the number of channels available is checked (Step 230).

Specifically, in Step 230, N is used to designate the total number of channels available in a call-by-call group, X designates the minimum number of channels that must be kept open for 911 call traffic, and Y is the number of channels in use at any time. Thus, the number Y represents calls of several types of traffic such as incoming, outgoing, 800, tie, foreign exchange, etc., each type typically having a minimum or maximum limit attached to the number of channels that can be occupied or reserved for the traffic type. However, since 911 is the highest priority traffic, all other traffic has been designated in this example by the value Y. Thus, in Step 230, the formula for determining whether or not to return a busy signal or to allow a call to proceed is: If $(N-X) - Y$ is equal to or greater than 1, the call will be accepted (Steps 235 and 240). If the value is less than 1, a busy signal is returned to the caller (Steps 245 and 250).

If the call is determined to be an emergency 911 call (Step 255), the extension number is translated to a 7 or 10-digit ITU-T E.164 number for that location (Step 265), and the call is routed to an ISDN trunk group (Step 270). The DID number is inserted in the calling party information element field of the setup message (Step 275), and the channel size is determined in the ISDN call-by-call trunk group (Step 280). Finally, the call is delivered to the public network (Step 285).

An alternative to the channel reservation algorithm discussed with reference to Figure 2, is to permanently assign one or more trunks/channels for 911 use. In systems where redundancy for signaling of the location information is required, the backup D-channel feature can be used. The D-channel is used to set up the call to the Emergency Service and it also carries the E.164 number which is then used to identify the location of the caller. Therefore, if for any reason the D-channel fails, the call will also fail and the location information will not be delivered.

Alternatives and variations of the invention are possible within the sphere and scope of the claims appended hereto.

APPENDIX A

3.1.14 SETUP

This message is sent by the calling user to the network and by the network to the called user to initiate call establishment.

See Table 3-15.

TABLE 3-15/Q.931

SETUP message content

Message type: SETUP Significance: global Direction: both				
Information element	Reference (subclause)	Direction	Type	Length
Protocol discriminator	4.2	Both	M	1
Call reference	4.3	Both	M	2-*
Message type	4.4	Both	M	1
Sending complete	4.5	Both	O (Note 1)	1
Repeat indicator	4.5	Both	O (Note 2)	1
Bearer capability	4.5	Both	M (Note 3)	4-12
Channel identification	4.5	Both	O (Note 4)	2-*
Progress indicator	4.5	Both	O (Note 5)	2-4
Network specific facilities	4.5	Both	O (Note 6)	2-*
Display	4.5	n → u	O (Note 7)	(Note 8)
Keypad facility	4.5	u → n	O (Note 9)	2-34
Signal	4.5	n → u	O (Note 10)	2-3
Calling party number	4.5	Both	O (Note 11)	2-*
Calling party subaddress	4.5	Both	O (Note 12)	2-23
Called party number	4.5	Both	O (Note 13)	2-*
Called party subaddress	4.5	Both	O (Note 14)	2-23
Transit network selection	4.5	u → n	O (Note 15)	2-*
Repeat indicator	4.5	Both	O (Note 16)	1
Low layer compatibility	4.5	Both	O (Note 17)	2-18
High layer compatibility	4.5	Both	O (Note 18)	2-5

NOTES

1. Included if the user or the network optionally indicates that all information necessary for call establishment is included in the SETUP message.
2. The Repeat indicator information element is included immediately before the first Bearer capability information element when the bearer capability negotiation procedure is used (see Annex L).
3. May be repeated if the bearer capability negotiation procedure is used (see Annex L). For bearer capability negotiation, two Bearer capability information elements may be included in descending order of priority, i.e. highest priority first. Although support of multiple Bearer capability information elements may not be supported on all networks, on networks that do support it, and through suitable subscription arrangements, two Bearer capability information elements may be included (see 5.11). When they are not preceded by a Repeat indicator information element, they are included in ascending order of priority.
4. Mandatory in the network-to-user direction. Included in the user-to-network direction when a user wants to indicate a channel. If not included, its absence is interpreted as "any channel acceptable".
5. Included in the event of interworking or in connection with the provision of in-band information/patterns.
6. Included by the calling user or the network to indicate network specific facilities information (see Annex E).
7. Included if the network provides information that can be presented to the user.
8. The minimum length is 2 octets: the maximum length is network dependent and is either 34 or 82 octets.
9. Either the Called party number or the Keypad facility information element is included by the user to convey called party number information to the network. The Keypad facility information element may also be included by the user to convey other call establishment information to the network.
10. Included if the network optionally provides additional information describing tones.
11. May be included by the calling user or the network to identify the calling user. Not included in the network-to-user direction for basic call control, but may be included for some supplementary services.
12. Included in the user-to-network direction when the calling user wants to indicate the calling party subaddress. Not included in the network-to-user direction for basic call control, but may be included for some supplementary services.
13. Either the Called party number or the Keypad facility information element is included by the user to convey called party number information to the network. The Called party number information element is included by the network when called party number information is to be conveyed to the user.
14. Included in the user-to-network direction when the calling user wants to indicate the called party subaddress. Included in the network-to-user direction if the calling user included a Called party subaddress information element in the SETUP message.

15. Included by the calling user to select a particular transit network (see Annex C).
16. Included when two or more Low layer compatibility information elements are included for low layer compatibility negotiation.
17. Included in the user-to-network direction when the calling user wants to pass low layer compatibility information to the called user. Included in the network-to-user direction if the calling user included a Low layer compatibility information element in the SETUP message. Two, three or four information elements may be included in descending order of priority, i.e. highest priority first, if the low layer compatibility negotiation procedures are used (see Annex J).
18. Included in the user-to-network direction when the calling user wants to pass high layer compatibility information to the called user. Included in the network-to-user direction if the calling user included a High layer compatibility information element in the SETUP message. Although support of multiple High layer compatibility information elements may not be supported on all networks, on networks that do support it, and through suitable subscription arrangements, two High layer compatibility information elements may be included (see 5.12). When then are not preceded by a Repeat indicator information element, they are included in ascending order of priority.

WHAT IS CLAIMED IS:

1. A system for handling a call requiring non-standard processing to a call
answer point and for providing location information concerning said call to said call
5 answer point, comprising:
call routing means for identifying said call as requiring non-standard
processing and in response providing a priority routing for said call;
translation table means for receiving said call via said priority routing and in
response assigning a predetermined designation for indicating said location
10 information; and
protocol harmonization means for formatting said call for digital transmission
to said call answer point, including inserting said predetermined designation in an
information portion of said digital transmission; and
digital interface means for receiving said call properly formatted for said
15 digital transmission and in response transmitting said call to said call answer point,
whereupon said call answer point ascertains the location of origination of said call
from said predetermined designation.
2. The system of claim 1, further comprising channel reservation means for
20 monitoring activity level of said call routing means and in the event said activity level
exceeds a predetermined amount then presenting a busy signal to all calls except calls
which require said non-standard processing.
3. The system of claim 1, wherein said digital interface means comprises a ISDN
25 BRI trunk circuit.
4. The system of claim 2, wherein said channel reservation means monitors said
activity level of said call routing means by calculating a result for $(N-X) - Y$, where N
represents the total number of channels available in a call-by-call group, X represents
30 the number of channels that must be kept open for calls requiring said non-standard
processing, and Y represents the number of channels in use at any time, wherein said
busy signal is presented in the event that said result is less than 1.

5. A method for handling a call requiring non-standard processing to a call answer point and for providing location information concerning said call to said call answer point, comprising the steps of:

identifying said call as one of either a call requiring non-standard processing
5 or a call requiring standard processing;

in the event that said call has been identified as a call requiring standard processing then routing said call to a trunk group connected to a public network, inserting an extension number from which said call originates in a calling party information element field of a setup message for said call over said trunk group,
10 monitoring call activity level and in the event said activity level exceeds a predetermined amount then presenting a busy signal to said call, and otherwise delivering said call to said public network; and

in the event that said call is identified as a call requiring non-standard processing, then routing said call to a translation server for translating said extension
15 number to an ITU-T E.164 number for identifying said location, routing said call to said trunk group, inserting said ITU-T E.164 number into said calling party information element field of said setup message, sizing said channel in said trunk group and delivering said call to said public network.

6. A system according to Claim 1, substantially as herein described with reference to and as shown in the drawings.

7. A method according to Claim 5, substantially as herein described with reference to and as shown in the drawings.



Application No: GB 9917644.8
Claims searched: 1 to 7

Examiner: Jared Stokes
Date of search: 25 August 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.Q): H4K (KF42)

Int CI (Ed.6): H04M (3/42, 11/04)
H04Q (3/72)

Other: On-Line - WPI, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0 512 704 A2 (Telident) See abstract	-
A	WO 92/07439 A1 (Chavous) See abstract	-

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
& Member of the same patent family

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